

CLAIMS

What is claimed is:

1. An autonegotiation circuit for Ethernet networks, comprising:
 - a first device that communicates with a first media;
 - a second device that communicates with a second media; and
 - a network interface connector (NIC) that communicates with said first device over said first media and with said second device over said second media, wherein said NIC provides autonegotiation between said first and second devices.
2. The autonegotiation circuit of claim 1 wherein said first device includes a first NIC interface including a transmitter and a receiver.
3. The autonegotiation circuit of claim 1 wherein said first media includes 1000BASE-LX media.
4. The autonegotiation circuit of claim 1 wherein said first media includes 1000BASE-SX media.
5. The autonegotiation circuit of claim 1 wherein said first media includes 1000BASE-X media.

6. The autonegotiation circuit of claim 1 wherein said second media includes 1000BASE-T media.

7. The autonegotiation circuit of claim 2 wherein said NIC includes a second NIC interface with a transmitter and a receiver.

8. The autonegotiation circuit of claim 7 wherein said NIC includes a first copper interface with a transmitter and a receiver.

9. The autonegotiation circuit of claim 8 wherein said second device includes a second copper interface with a transmitter and a receiver.

10. The autonegotiation circuit of claim 9 wherein said transmitter of said first NIC interface communicates with said receiver of said second NIC interface and said receiver of said first NIC interface communicates with said transmitter of said second NIC interface.

11. The autonegotiation circuit of claim 10 wherein said transmitter of said first copper interface communicates with said receiver of said second copper interface and said receiver of said first copper interface communicates with said transmitter of said second copper interface.

12. The autonegotiation circuit of claim 11 wherein said transmitters of said first and second NIC interfaces transmit a first configuration ordered set.

13. The autonegotiation circuit of claim 12 wherein after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said first device that is contained in said second configuration ordered set, said transmitter of said first copper interface transmits a first FLP burst.

14. The autonegotiation circuit of claim 13 wherein said first FLP burst contains at least one configuration parameter provided by said first configuration data.

15. The autonegotiation circuit of claim 14 wherein said first copper interface and said second copper interface complete autonegotiation by exchanging additional data and establishing a link.

16. The autonegotiation circuit of claim 15 wherein said transmitter of said second copper interface transmits second configuration data that is stored in said memory of said NIC.

17. The autonegotiation circuit of claim 16 wherein said transmitter of said second NIC interface generates a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data.

18. The autonegotiation circuit of claim 17 wherein said first and second NIC interfaces establish a link.

19. The autonegotiation circuit of claim 18 wherein when said link between said first and second NIC interfaces is lost, autonegotiation is initiated between said first and second NIC interfaces, and wherein when said link between said first and second copper interfaces is lost, autonegotiation is initiated between said first and second copper interfaces.

20. An autonegotiation circuit for Ethernet networks, comprising:
- a switch that communicates with a first media;
 - a device that communicates with a second media that is a different type of media than said first media; and
 - a network interface connector (NIC) that communicates with said switch over said first media and with said device over said second media, wherein said NIC allows autonegotiation between said switch and said device.
21. The autonegotiation circuit of claim 20 wherein said first media includes 1000BASE-LX media.
22. The autonegotiation circuit of claim 20 wherein said first media includes 1000BASE-SX media.
23. The autonegotiation circuit of claim 20 wherein said first media includes 1000BASE-X media.
24. The autonegotiation circuit of claim 20 wherein said switch includes a first NIC interface with a transmitter and a receiver, said NIC includes a second NIC interface with a transmitter and a receiver and a first copper interface with a transmitter and a receiver, and said device includes a second copper interface with a transmitter and a receiver.

25. The autonegotiation circuit of claim 24 wherein said transmitter of said first NIC interface communicates with said receiver of said second NIC interface and said receiver of said first NIC interface communicates with said transmitter of said second NIC interface.

26. The autonegotiation circuit of claim 25 wherein said transmitter of said first copper interface communicates with said receiver of said second copper interface and said receiver of said first copper interface communicates with said transmitter of said second copper interface.

27. The autonegotiation circuit of claim 26 wherein said transmitters of said first and second NIC interfaces transmit a first configuration ordered set.

28. The autonegotiation circuit of claim 27 wherein said transmitter of said first copper interface does not transmit a fast link pulse (FLP) burst until said transmitter of said first NIC interface transmits said first configuration ordered set.

29. The autonegotiation circuit of claim 28 wherein after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said switch that is contained in said second configuration ordered set, said transmitter of said first copper interface transmits a first FLP burst.

30. The autonegotiation circuit of claim 29 wherein said first FLP burst generated by said first copper interface contains at least one configuration parameter provided by said first configuration data.

31. The autonegotiation circuit of claim 30 wherein said first copper interface and said second copper interface complete 1000BASE-T autonegotiation by exchanging additional data and establishing a 1000BASE-T link.

32. The autonegotiation circuit of claim 31 wherein said memory of said NIC stores second configuration data of said device.

33. The autonegotiation circuit of claim 32 wherein said transmitter of said second NIC interface generates a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data.

34. The autonegotiation circuit of claim 33 wherein said first NIC interface and said second NIC interface complete 1000BASE-X autonegotiation and establish a 1000BASE-X link.

35. An autonegotiation circuit for Ethernet networks, comprising:
- first means for communicating with a first media;
- second means for communicating with a second media; and
- network interfacing means for communicating with said first means over said first media and with said second means over said second media and for providing autonegotiation between said first and second devices.
36. The autonegotiation circuit of claim 35 wherein said first means includes a first network interfacing means including a transmitter and a receiver.
37. The autonegotiation circuit of claim 35 wherein said first media includes 1000BASE-LX media.
38. The autonegotiation circuit of claim 35 wherein said first media includes 1000BASE-SX media.
39. The autonegotiation circuit of claim 35 wherein said first media includes 1000BASE-X media.
40. The autonegotiation circuit of claim 35 wherein said second media includes 1000BASE-T media.

41. The autonegotiation circuit of claim 36 wherein said network interfacing means includes:

a second network interface with a transmitter and a receiver; and
a first copper interface with a transmitter and a receiver.

42. The autonegotiation circuit of claim 41 wherein said second means includes a second copper interface with a transmitter and a receiver.

43. The autonegotiation circuit of claim 42 wherein said transmitter of said first network interface communicates with said receiver of said second network interface and said receiver of said first network interface communicates with said transmitter of said second network interface.

44. The autonegotiation circuit of claim 43 wherein said transmitter of said first copper interface communicates with said receiver of said second copper interface and said receiver of said first copper interface communicates with said transmitter of said second copper interface.

45. The autonegotiation circuit of claim 44 wherein said transmitters of said first and second network interfaces transmit a first configuration ordered set.

46. The autonegotiation circuit of claim 45 wherein after said receiver of said second network interface receives a second configuration ordered set from said transmitter of said first network interface and said network interfacing means stores in memory first configuration data of said first means that is contained in said second configuration ordered set, said transmitter of said first copper interface transmits a first FLP burst.

47. The autonegotiation circuit of claim 46 wherein said first FLP burst contains at least one configuration parameter provided by said first configuration data.

48. The autonegotiation circuit of claim 47 wherein said first copper interface and said second copper interface complete autonegotiation by exchanging additional data and establishing a link.

49. The autonegotiation circuit of claim 48 wherein said transmitter of said second copper interface transmits second configuration data that is stored in said memory of said network interfacing means.

50. The autonegotiation circuit of claim 49 wherein said transmitter of said second network interface generates a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data.

51. The autonegotiation circuit of claim 50 wherein said first and second network interfaces establish a link.

52. The autonegotiation circuit of claim 51 wherein when said link between said first and second network interfaces is lost, autonegotiation is initiated between said first and second network interfaces, and wherein when said link between said first and second copper interfaces is lost, autonegotiation is initiated between said first and second copper interfaces.

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53. A method for establishing a link on an Ethernet network, comprising:

coupling a first media to a first device;

coupling a second media to a second device, wherein said second media is a different type of media than said first media; and

using a network interface connector (NIC) to communicate with said first device over said first media and with said second device over said second media, wherein said NIC allows autonegotiation between said first and second devices.

54. The method of claim 53 further comprising providing a first NIC interface including a transmitter and a receiver in said first device.

55. The method of claim 53 wherein said first media includes 1000BASE-LX media.

56. The method of claim 53 wherein said first media includes 1000BASE-SX media.

57. The method of claim 53 wherein said first media includes 1000BASE-X media.

58. The method of claim 53 wherein said second media includes 1000BASE-T media.

59. The method of claim 54 further comprising providing a second NIC interface with a transmitter and a receiver in said NIC.

60. The method of claim 59 further comprising providing a first copper interface with a transmitter and a receiver in said NIC.

61. The method of claim 60 further comprising providing a second copper interface with a transmitter and a receiver in said second device.

62. The method of claim 61 further comprising establishing communications between said transmitter of said first NIC interface and said receiver of said second NIC interface and between said receiver of said first NIC interface and said transmitter of said second NIC interface.

63. The method of claim 62 further comprising establishing communications between said transmitter of said first copper interface and said receiver of said second copper interface and between said receiver of said first copper interface and said transmitter of said second copper interface.

64. The method of claim 63 further comprising transmitting a first configuration ordered set using said transmitters of said first and second NIC interfaces.

65. The method of claim 64 further comprising transmitting a first FLP burst using said transmitter of said first copper interface after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said first device that is contained in said second configuration ordered set.

66. The method of claim 65 further comprising inserting at least one configuration parameter provided by said first configuration data in said first FLP burst.

67. The method of claim 66 further comprising completing autonegotiation by exchanging additional data and establishing a link between said first copper interface and said second copper interface.

68. The method of claim 67 further comprising transmitting second configuration data that is stored in said memory of said NIC using said transmitter of said second copper interface.

69. The method of claim 68 further comprising generating a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data using said transmitter of said second NIC interface.

70. The method of claim 69 further comprising establishing a link between said first and second NIC interfaces.

71. The method of claim 70 further comprising initiating autonegotiation between said first and second NIC interfaces when said link between said first and second NIC interfaces is lost.

72. The method of claim 71 further comprising initiating autonegotiation between said first and second copper interfaces when said link between said first and second copper interfaces is lost.

73. An Ethernet network, comprising:

- a first device that communicates with a first media;
- a second device that communicates with a second media, wherein said first media is a different media than said second media; and
- a network interface connector (NIC) that communicates with said first device over said first media and with said second device over said second media, wherein said NIC provides autonegotiation between said first and second devices.

74. The Ethernet network of claim 73 wherein said first device includes a first NIC interface including a transmitter and a receiver.

75. The Ethernet network of claim 73 wherein said first media includes 1000BASE-LX media.

76. The Ethernet network of claim 73 wherein said first media includes 1000BASE-SX media.

77. The Ethernet network of claim 73 wherein said first media includes 1000BASE-X media.

78. The Ethernet network of claim 73 wherein said second media includes 1000BASE-T media.

79. The Ethernet network of claim 74 wherein said NIC includes a second NIC interface with a transmitter and a receiver.

80. The Ethernet network of claim 79 wherein said NIC includes a first copper interface with a transmitter and a receiver.

81. The Ethernet network of claim 80 wherein said second device includes a second copper interface with a transmitter and a receiver.

82. The Ethernet network of claim 81 wherein said transmitter of said first NIC interface communicates with said receiver of said second NIC interface and said receiver of said first NIC interface communicates with said transmitter of said second NIC interface.

83. The Ethernet network of claim 82 wherein said transmitter of said first copper interface communicates with said receiver of said second copper interface and said receiver of said first copper interface communicates with said transmitter of said second copper interface.

84. The Ethernet network of claim 83 wherein said transmitters of said first and second NIC interfaces transmit a first configuration ordered set.

85. The Ethernet network of claim 84 wherein after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said first device that is contained in said second configuration ordered set, said transmitter of said first copper interface transmits a first FLP burst.

86. The Ethernet network of claim 85 wherein said first FLP burst contains at least one configuration parameter provided by said first configuration data.

87. The Ethernet network of claim 86 wherein said first copper interface and said second copper interface complete autonegotiation by exchanging additional data and establishing a link.

88. The Ethernet network of claim 87 wherein said transmitter of said second copper interface transmits second configuration data that is stored in said memory of said NIC.

89. The Ethernet network of claim 88 wherein said transmitter of said second NIC interface generates a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data.

90. The Ethernet network of claim 89 wherein said first and second NIC interfaces establish a link.

91. The Ethernet network of claim 90 wherein when said link between said first and second NIC interfaces is lost, autonegotiation is initiated between said first and second NIC interfaces, and wherein when said link between said first and second copper interfaces is lost, autonegotiation is initiated between said first and second copper interfaces.

92. A software method for establishing a link on an Ethernet network, comprising:

coupling a first media to a first device;

coupling a second media to a second device, wherein said second media is a different type of media than said first media; and

using a network interface connector (NIC) to communicate with said first device over said first media and with said second device over said second media, wherein said NIC allows autonegotiation between said first and second devices.

93. The software method of claim 92 further comprising providing a first NIC interface including a transmitter and a receiver in said first device.

94. The software method of claim 92 wherein said first media includes 1000BASE-LX media.

95. The software method of claim 92 wherein said first media includes 1000BASE-SX media.

96. The software method of claim 92 wherein said first media includes 1000BASE-X media.

97. The software method of claim 92 wherein said second media includes 1000BASE-T media.

98. The software method of claim 93 further comprising providing a second NIC interface with a transmitter and a receiver in said NIC.

99. The software method of claim 98 further comprising providing a first copper interface with a transmitter and a receiver in said NIC.

100. The software method of claim 99 further comprising providing a second copper interface with a transmitter and a receiver in said second device.

101. The software method of claim 100 further comprising establishing communications between said transmitter of said first NIC interface and said receiver of said second NIC interface and between said receiver of said first NIC interface and said transmitter of said second NIC interface.

102. The software method of claim 101 further comprising establishing communications between said transmitter of said first copper interface and said receiver of said second copper interface and between said receiver of said first copper interface and said transmitter of said second copper interface.

103. The software method of claim 102 further comprising transmitting a first configuration ordered set using said transmitters of said first and second NIC interfaces.

104. The software method of claim 103 further comprising transmitting a first FLP burst using said transmitter of said first copper interface after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said first device that is contained in said second configuration ordered set.

105. The software method of claim 104 further comprising inserting at least one configuration parameter provided by said first configuration data in said first FLP burst.

106. The software method of claim 105 further comprising completing autonegotiation by exchanging additional data and establishing a link between said first copper interface and said second copper interface.

107. The software method of claim 106 further comprising transmitting second configuration data that is stored in said memory of said NIC using said transmitter of said second copper interface

108. The software method of claim 107 further comprising generating a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data using said transmitter of said second NIC interface

109. The software method of claim 108 further comprising establishing a link between said first and second NIC interfaces

110. The software method of claim 109 further comprising initiating autonegotiation between said first and second NIC interfaces when said link between said first and second NIC interfaces is lost.

111. The software method of claim 110 further comprising initiating autonegotiation between said first and second copper interfaces when said link between said first and second copper interfaces is lost.

112. An Ethernet network, comprising:
- first means for communicating with a first media;
- second means for communicating with a second media, wherein
said first media is a different media than said second media; and
- network interface means for communicating with said first means
over said first media and with said second means over said second media and
for providing autonegotiation between said first and second means.
113. The Ethernet network of claim 112 wherein said first means
includes a first interface including a transmitter and a receiver.
114. The Ethernet network of claim 112 wherein said first media includes
1000BASE-LX media.
115. The Ethernet network of claim 112 wherein said first media includes
1000BASE-SX media.
116. The Ethernet network of claim 112 wherein said first media includes
1000BASE-X media.
117. The Ethernet network of claim 112 wherein said second media
includes 1000BASE-T media.

118. The Ethernet network of claim 113 wherein said network interface means includes a second interface with a transmitter and a receiver.

119. The Ethernet network of claim 118 wherein said network interface means includes a first copper interface with a transmitter and a receiver.

120. The Ethernet network of claim 119 wherein said second means includes a second copper interface with a transmitter and a receiver.

121. The Ethernet network of claim 120 wherein said transmitter of said first interface communicates with said receiver of said second interface and said receiver of said first interface communicates with said transmitter of said second interface.

122. The Ethernet network of claim 121 wherein said transmitter of said first copper interface communicates with said receiver of said second copper interface and said receiver of said first copper interface communicates with said transmitter of said second copper interface.

123. The Ethernet network of claim 122 wherein said transmitters of said first and second interfaces transmit a first configuration ordered set.

124. The Ethernet network of claim 123 wherein after said receiver of said second interface receives a second configuration ordered set from said transmitter of said first interface and said network interface means stores in memory first configuration data of said first means that is contained in said second configuration ordered set, said transmitter of said first copper interface transmits a first FLP burst.

125. The Ethernet network of claim 124 wherein said first FLP burst contains at least one configuration parameter provided by said first configuration data.

126. The Ethernet network of claim 125 wherein said first copper interface and said second copper interface complete autonegotiation by exchanging additional data and establishing a link.

127. The Ethernet network of claim 126 wherein said transmitter of said second copper interface transmits second configuration data that is stored in said memory of said network interface means.

128. The Ethernet network of claim 127 wherein said transmitter of said second interface generates a second configuration ordered set that contains at least one configuration parameter provided by said second configuration data.

129. The Ethernet network of claim 128 wherein said first and second interfaces establish a link.

130. The Ethernet network of claim 129 wherein when said link between said first and second interfaces is lost, autonegotiation is initiated between said first and second interfaces, and wherein when said link between said first and second copper interfaces is lost, autonegotiation is initiated between said first and second copper interfaces.

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131. A method for establishing a link on an Ethernet network, comprising:

coupling a first media to a switch;

coupling a second media to a device, wherein said second media is a different type of media than said first media; and

using a network interface connector (NIC) to communicate with said switch over said first media and with said device over said second media, wherein said NIC allows autonegotiation between said switch and said device.

132. The method of claim 131 further comprising providing a first NIC interface including a transmitter and a receiver in said switch.

133. The method of claim 131 wherein said first media includes 1000BASE-LX media.

134. The method of claim 131 wherein said first media includes 1000BASE-SX media.

135. The method of claim 131 wherein said first media includes 1000BASE-X media.

136. The method of claim 131 wherein said second media includes 1000BASE-T media.

137. The method of claim 132 further comprising providing a second NIC interface with a transmitter and a receiver in said NIC.

138. The method of claim 137 further comprising providing a first copper interface with a transmitter and a receiver in said NIC.

139. The method of claim 138 further comprising providing a second copper interface with a transmitter and a receiver in said device.

140. The method of claim 139 further comprising establishing communications between said transmitter of said first NIC interface and said receiver of said second NIC interface and between said receiver of said first NIC interface and said transmitter of said second NIC interface.

141. The method of claim 140 further comprising establishing communications between said transmitter of said first copper interface and said receiver of said second copper interface and between said receiver of said first copper interface and said transmitter of said second copper interface.

142. The method of claim 141 further comprising transmitting a first configuration ordered set using said transmitters of said first and second NIC interfaces.

143. The method of claim 142 further comprising transmitting a first FLP burst using said transmitter of said first copper interface after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said switch that is contained in said second configuration ordered set.

144. The method of claim 143 further comprising inserting at least one configuration parameter provided by said first configuration data in said first FLP burst.

145. The method of claim 144 further comprising completing autonegotiation by exchanging additional data and establishing a link between said first copper interface and said second copper interface.

146. The method of claim 145 further comprising transmitting second configuration data that is stored in said memory of said NIC using said transmitter of said second copper interface

147. The method of claim 146 further comprising generating a second configuration ordered set that contains at least one configuration parameter

provided by said second configuration data using said transmitter of said second NIC interface

148. The method of claim 147 further comprising establishing a link between said first and second NIC interfaces

149. The method of claim 148 further comprising initiating autonegotiation between said first and second NIC interfaces when said link between said first and second NIC interfaces is lost.

150. The method of claim 149 further comprising initiating autonegotiation between said first and second copper interfaces when said link between said first and second copper interfaces is lost.

151. A software method for establishing a link on an Ethernet network, comprising:

coupling a first media to a switch;

coupling a second media to a device, wherein said second media is a different type of media than said first media; and

using a network interface connector (NIC) to communicate with said switch over said first media and with said device over said second media, wherein said NIC allows autonegotiation between said switch and said device.

152. The software method of claim 151 further comprising providing a first NIC interface including a transmitter and a receiver in said switch.

153. The software method of claim 151 wherein said first media includes 1000BASE-LX media.

154. The software method of claim 151 wherein said first media includes 1000BASE-SX media.

155. The software method of claim 151 wherein said first media includes 1000BASE-X media.

156. The software method of claim 151 wherein said second media includes 1000BASE-T media.

157. The software method of claim 152 further comprising providing a second NIC interface with a transmitter and a receiver in said NIC.

158. The software method of claim 157 further comprising providing a first copper interface with a transmitter and a receiver in said NIC.

159. The software method of claim 158 further comprising providing a second copper interface with a transmitter and a receiver in said device.

160. The software method of claim 159 further comprising establishing communications between said transmitter of said first NIC interface and said receiver of said second NIC interface and between said receiver of said first NIC interface and said transmitter of said second NIC interface.

161. The software method of claim 160 further comprising establishing communications between said transmitter of said first copper interface and said receiver of said second copper interface and between said receiver of said first copper interface and said transmitter of said second copper interface.

162. The software method of claim 161 further comprising transmitting a first configuration ordered set using said transmitters of said first and second NIC interfaces.

163. The software method of claim 162 further comprising transmitting a first FLP burst using said transmitter of said first copper interface after said receiver of said second NIC interface receives a second configuration ordered set from said transmitter of said first NIC interface and said NIC stores in memory first configuration data of said switch that is contained in said second configuration ordered set.

164. The software method of claim 163 further comprising inserting at least one configuration parameter provided by said first configuration data in said first FLP burst.

165. The software method of claim 164 further comprising completing autonegotiation by exchanging additional data and establishing a link between said first copper interface and said second copper interface.

166. The software method of claim 165 further comprising transmitting second configuration data that is stored in said memory of said NIC using said transmitter of said second copper interface

167. The software method of claim 166 further comprising generating a second configuration ordered set that contains at least one configuration

parameter provided by said second configuration data using said transmitter of said second NIC interface

168. The software method of claim 167 further comprising establishing a link between said first and second NIC interfaces

169. The software method of claim 168 further comprising initiating autonegotiation between said first and second NIC interfaces when said link between said first and second NIC interfaces is lost.

170. The software method of claim 169 further comprising initiating autonegotiation between said first and second copper interfaces when said link between said first and second copper interfaces is lost.